DEC set to haul in DECnet V

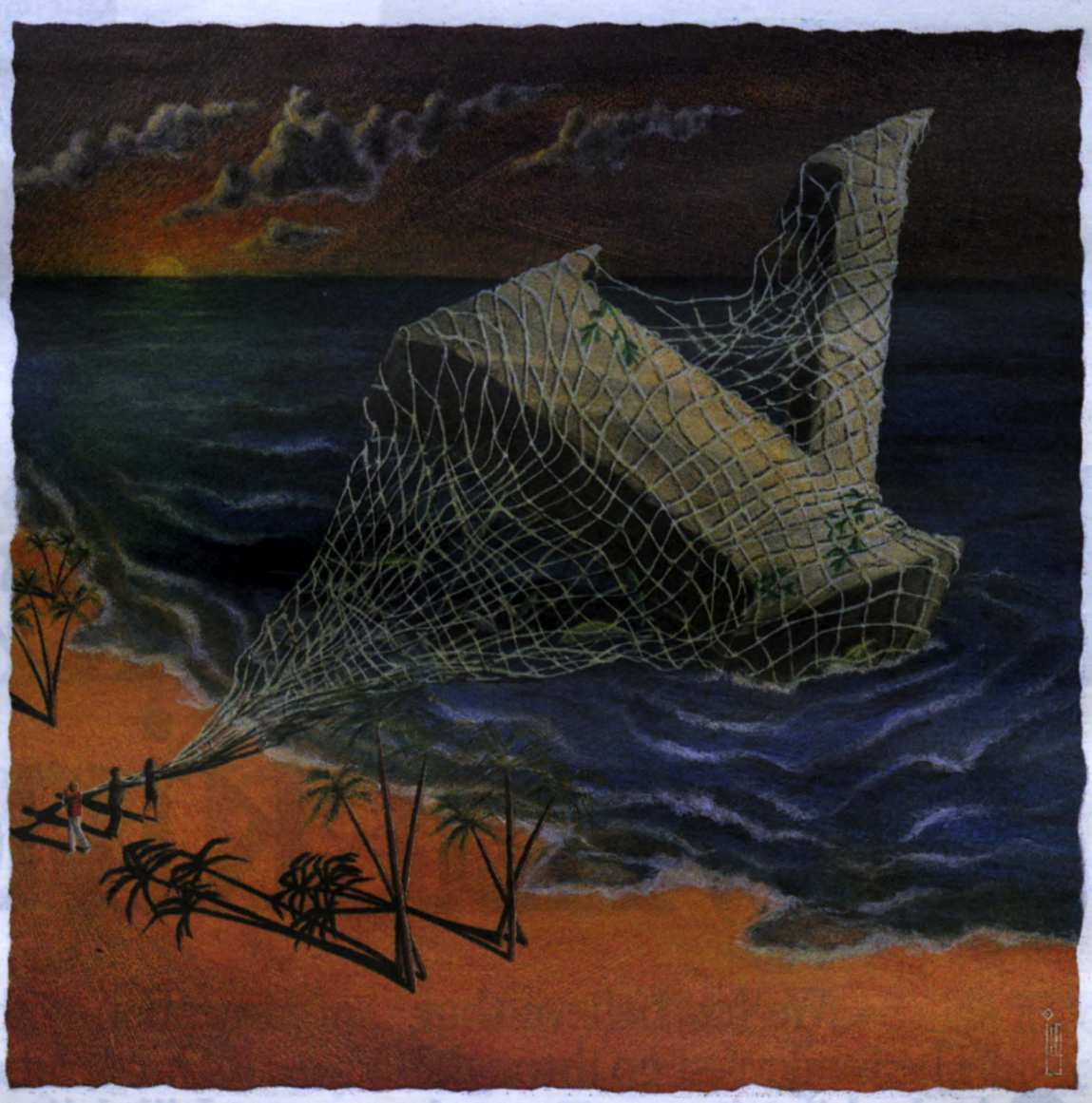
By CARL MALAMUD

Like IBM with its Systems Application Architecture, Digital Equipment Corp. has made a major corporate commitment to an architecture that it hopes will conquer the future.

The new architecture, DECnet/OSI Phase V — which DEC has been working on for more than two years — aims not only to continue connectivity with DEC's existing products (which currently use DECnet Phase IV), but also to provide interconnectivity with Open Systems Interconnection-compatible systems.

Those are its intentions. But the real test of Phase V will be if future DEC products achieve this grand vision of interoperability.

DEC is shooting for more than just peaceful coexistence with its competitors. The company's goal is true integration of OSI, Transmission Control Protocol/Internet Protocol and DECnet protocol stacks. DEC wants users to be able to access any service transparently, no matter what kind of network they're on.



Say hello, wilkommen, bienvenue to multilingual protocol stacks.

OSI compatibility

Phase V's original mandate was to support OSI, hence the new product name — DECnet/OSI. To accomplish that, DEC had to make major changes at all levels of the traditional DECnet protocol stack.

First, the subnetwork technologies, which are defined as datalink services that allow a system to send a packet directly to another system without the intervention of a router, had to be greatly expanded.

In addition to already existing support for Ethernet and DEC's proprietary Digital Data Communications Message Protocol, DEC added support for such international standards as High-Level Data Link Control and the Fiber Distributed Data Interface, as well as increased support for X.25.

Phase V's support for X.25 il-

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Malamud is a San Francisco-based author of several books on networks and data bases, including Analyzing DECnet/OSI Phase V, *which is scheduled to be published in August (Van Norstrand Reinholt, New York).*

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lustrates one of the major differences between Phase IV and V. With Phase IV, X.25 could link nodes but only with a permanent virtual circuit. One major disadvantage to that approach was that an X.25 call had to be maintained even if no traffic was going through. That's equivalent to keeping a dedicated telephone line for two people that need to talk only occasionally.

With Phase V, DEC added a feature known as "dynamically established data links." These links allow the network to place an X.25 call only when needed. The call stays in place for a short period of time — say, 30 seconds — in case there is more traffic for that same destination. If there is no more traffic, the call is automatically disconnected by the network.

The biggest change in DECnet/OSI is compatibility with the OSI network-layer protocols. With true OSI compatibility at the network layer, not only are end nodes interoperable, but routers from different vendors can also communicate. Connecting routers allows users to take advantage of dynamic routing, in which topology changes in the network are dynamically discovered by routers. Dynamic routing is a fundamental part of Phase V and a feature that is rapidly progressing toward OSI standard status.

A typical DECnet/OSI Phase V network will isolate networks into domains, each served by one or more routers (see Figure 1 on page 54), which handle traffic inside the domain and serve as a link to other domains. Often, a public network technology such as X.25 will form the bridge between the two routing domains. Other public network technologies, such as Integrated Services Digital Network, Switched Multimegabit Data Service, frame relay or related standards, may be added in the future.

Using the network

Built on top of the transport layer are the three upper layers — session, presentation and application — of the network architecture, which ultimately provide services to end users. DECnet Phase V provides two broad classes of services: proprietary DECnet services and OSI services. Proprietary DECnet services provide backward compatibility and support for features that have not yet been standardized.

DECnet's OSI services provide multivendor interoperability. The OSI platform has standards in a wide variety of areas used to provide services in the network.

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What's in a name?

Digital Equipment Corp.'s DECnet Phase IV was limited to 63,000 nodes per network. However, Phase V, with an address space of 20 bytes, has a virtually unlimited number of nodes.

There's a problem, though. How do you find the particular node you want? What about a particular program? What about people to whom you want to send electronic mail?

Naming is a crucial part of DECnet/OSI Phase V. DEC's Digital Network Architecture Naming Service (DNS) allows a user to find the location of a given object on the network. Because the Open Software Foundation has accepted DNS as part of its Distributed Communications Environment, DNS will have a potential impact on many different computing environments.

DNS is known as a primitive naming service: If we know the full name of an object, DNS will give us back a set of the object's attributes, such as its network address. Other attributes can be defined by the users.

For example, an attribute of the object "username" might be a password, allowing the naming service to act as an authentication server.

A higher level of naming is the descriptive service, typified by the international X.500 standards. While DNS requires that the user know the object name, X.500 allows users to locate a user or object name even if it is only working with partial information.

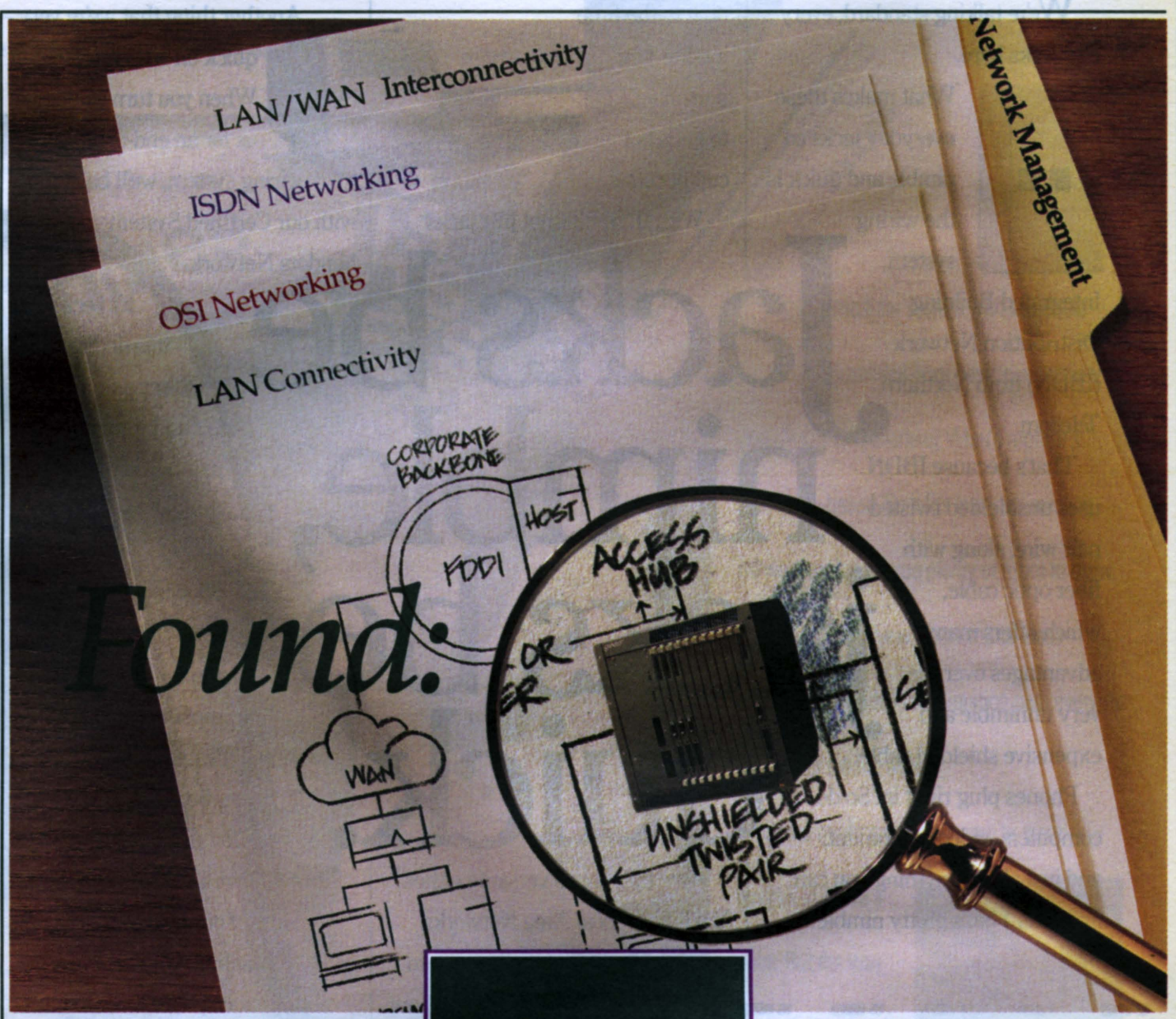
Both X.500 and DNS allow a series of attributes to be returned, for example, the network address. Separating a name from an address allows a service or object to be moved around the network or be offered in several different computers.

Addresses also provide an insulating function. The network layer of the net takes the address and figures out how to get to that particular node. Keeping the address separate from the route used to reach that address allows the network layer to decide among many different paths to an object each time the user requests information about that object.

Thus, a network with all four levels can return a set of attributes such as a network address, find the location with partial information, separate the name from the address, and keep the address separate from the path used to reach that address. All of these naming levels are needed in a network.

With X.500, we can search a global directory to find a unique object name. DNS then allows us to find the location or other attributes of that object quickly. Once we have the address, the network layer will find out how to get to that object.

— Carl Malamud



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DEC supports a subset of those OSI standards, such as File Transfer, Access and Management (FTAM) for file access and X.400 for message transfer.

Both OSI and DECnet services share the underlying infrastructure — the physical, network and transport layers — of the network architecture. Access to that infrastructure is provided by each service's distinct session layer. Both session layers can then access the infrastructure to start connections and move data.

While FTAM provides interoperability, a large installed base of DECnet users have programs written to use the Data Access Protocol (DAP) — DEC's proprietary equivalent to FTAM. Although FTAM is a more modern file access mechanism, supporting DAP is important for backward compatibility.

All of the upper layers of DECnet remain backward compatible. For example, the Network Services Protocol, DEC's proprietary transport layer, coexists with the OSI Transport Protocol, and the DECnet session control layer is backward compatible and sits alongside the OSI session control layer.

This simultaneous coexistence allows users to migrate gradually to Phase V. DEC advises users to move a small group of computers to Phase V initially and connect them to the existing network using the backward-compatibility features of Phase V. Then, users can gradually migrate the other nodes over.

Supplementing standards

In several areas, such as time synchronization, remote procedure calls (RPC) and naming services, DEC has chosen not to wait for the standards process, instead providing what it calls value-added services. For example, DEC's Digital Network Architecture Naming Service provides replication of the name space, a service the international X.500 committee is just beginning to address (see "What's in a name?" page 49).

In addition, a variety of other support services are part of the Phase V architecture. A time protocol is used to coordinate the clocks of different computers, a function that is crucial in today's distributed environment. For example, with a distributed data base, if two users are attempting to update the same data, the coordinated timing function ensures that the latest update is the one that takes effect.

RPC is another support standard. DEC has teamed up with the Apollo Division of Hewlett-Packard Co. in the RPC wars. DEC's naming service, together with Apollo's RPC, the Network Computing System, forms the foundation for the Open Software Foundation's Distributed Communications Environment.

The RPC mechanism is crucial in today's distributed networks because it is the programmer's entry point to the network. The programmer designs a collection of procedures that compose a program. The RPC protocols allow the procedures to be moved to different computers, distributing the program into a client/server architecture. Instead of worrying about transport- and network-layer issues, the programmer is able to think in terms of procedures, which is a more natural paradigm.

TCP/IP compatibility

TCP/IP's popularity among users has caught many large vendors by surprise. Many of them were deep into the details of their own computing architectures and didn't think TCP/IP was worth worrying about. Original Phase V plans made no mention of TCP/IP, but during the past year, DEC has reevaluated the role TCP/IP should play in its new architecture.

DEC has long provided TCP/IP support, but as an alternative to DECnet. TCP/IP offerings extend across both VMS and Ultrix operating systems, and even include support for Sun Microsystems, Inc.'s Network File System (NFS). The DECnet-Ultrix Internet Gateway provides application-layer interconnectivity of remote logon, mail transfer and file-transfer services between DECnet proprietary protocols

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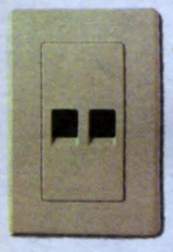
We're talking standard, everyday jacks here.



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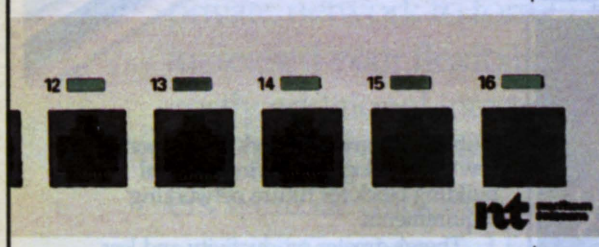

And quick?

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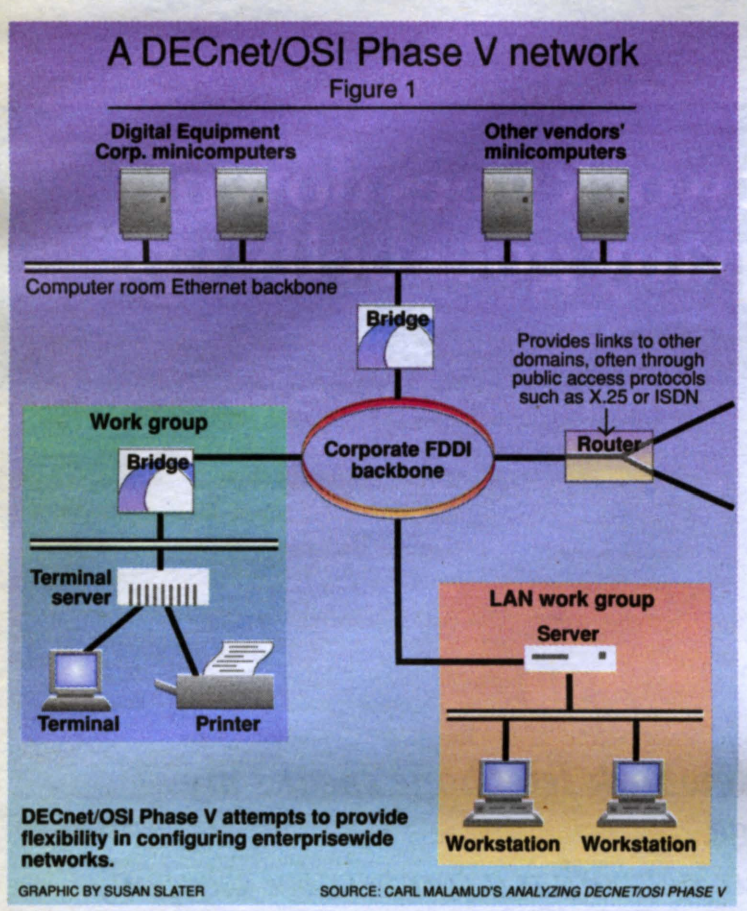

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and their equivalent TCP/IP services.

In addition to native TCP/IP and NFS support and the DECnet-Ultrix Internet Gateway, Phase V attempts to add integration of TCP/IP at the network layer. For example, routers are being built that allow both TCP/IP and DECnet/OSI traffic to be routed. These routers enable users to integrate multiple protocols into a single enterprisewide network.

A final layer of integration of TCP/IP and DECnet is with the network management platform. The DEC Management Control Center (DECmcc) allows a single management director to control and observe TCP/IP, OSI and DECnet networks (see "Managing multiprotocol environments," this page).

For OSI and DECnet environments, the Common Management Information Protocol (CMIP) is used as a network management protocol. For TCP/IP environments, the Simple Network Management Protocol (SNMP) is used to request network management information. The DECmcc network management station supports both CMIP and SNMP, allowing management of several architectures from a single net management station.

With DECnet/OSI Phase V, DEC may have bitten off more than it can chew. The company is trying to keep its products compatible with a huge installed base of Phase IV nodes while providing compatibility with the emerging international computing environment based on OSI. To make things even more complicated, the company has added more TCP/IP support.

If the plan works, users will be able to let a DECnet coexist with another vendor's computing environment. Naturally, DEC's goal is to sell hardware and software. Multivendor networking opens up several sales areas to the company. There's a risk: If DEC's products are not up to par, then instead of invading other vendors' turf, it has allowed the other vendors to invade DEC accounts.

DEC is pursuing a two-part strategy. First, it wants to retain its current accounts. Instead of offering simply OSI, the company offers OSI, backward compatibility and what DEC calls value-added supplementary services. Thus, DEC sales representatives can argue that buying other vendors' OSI software and hardware will mean a loss in functionality.

The second part of DEC's strategy involves invading the opposition's turf. With a universal network management station, DEC equipment can be used to manage other vendors' networks. With OSI and TCP/IP compatibility, DEC hardware can be used as servers for other vendors' workstations. Once DEC gets its products in the door with compatibility, it will be in a position to attempt to distinguish itself with value-added services.

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That brings up the matter of equipment. True Phase V-compatible equipment has been slow to appear. Of course, DEC has older OSI and TCP/IP products. Some of the more recently announced OSI capabilities include OSI support for VMS and Ultrix. This preliminary OSI support allows FTAM, X.400 and other major services to be executed, but it does not integrate the OSI services into DECnet in the way in which DECnet Phase V intends.

Although Phase V products are currently sparse, DEC hopes that giving users a coherent, long-term vision of its strategy for dealing with TCP/IP and OSI will keep them from moving toward other vendors' architectures.

The true test of DEC's grand strategic vision will be in products. If its offerings achieve its interoperability objective, DEC will do well. Meanwhile, DECnet Phase V is likely to open a lot of doors for DEC. What will be interesting, however, is whether the company can keep them open.

Networks key to surviving strike

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many carriers more quickly, which would be critical in a rail strike situation," Anderson said.

EDI and tracking systems would have helped trucking companies maximize their fleet and capitalize on new business opportunities during the strike.

Burlington Motor Carriers, for example, uses a satellite-based tracking system that enables a dispatcher to send textual electronic messages to truck drivers anywhere in the country informing them of their next destination. The system also uses Loran, a long-range navigational system, to pinpoint the location of drivers.

During a rail strike, Burlington Motor's tracking system could have enabled it to redeploy trucks more quickly to handle an influx of new shipping orders.

"Our tracking system would have enabled us to increase the utilization of our fleet during a strike," said Scott Blalock, manager of telecommunications at Burlington Motor in Hurst, Texas. "Our trucks would have been able to move more loads per day and run fewer empty miles."

In addition, EDI and tracking systems could have helped some rail carriers better weather the strike. Bob Schotman, director of customer information services at CSX Transportation, Inc., a large rail carrier, said EDI would have been invaluable had CSX's management decided to continue running the railroad using managers to replace striking workers.

CSX uses EDI to receive bills of lading, send out freight bills and track shipments, eliminating much of the paperwork needed to administer the railroad. This reduction in clerical work would have made it possible for CSX's management to continue operations throughout an extended strike, Schotman said.

Managing multiprotocol environments

Network management protocols are all the rage in today's multivendor, multiarchitecture data communications environments. There's a problem, though: If you have multiple architectures, you need multiple management protocols.

Open Systems Interconnection networks use the Common Management Information Protocol (CMIP). That takes care of true OSI as well as Digital Equipment Corp.'s DECnet Phase V.

But what about Phase IV? It uses a different management protocol known as the Network Information Control and Exchange (NICE). And what about Transmission Control Protocol/Internet Protocol? It uses the Simple Network Management Protocol (SNMP).

What about T-1 wide-area links? Ethernet bridges? Terminal servers? Three more protocols to add to the list.

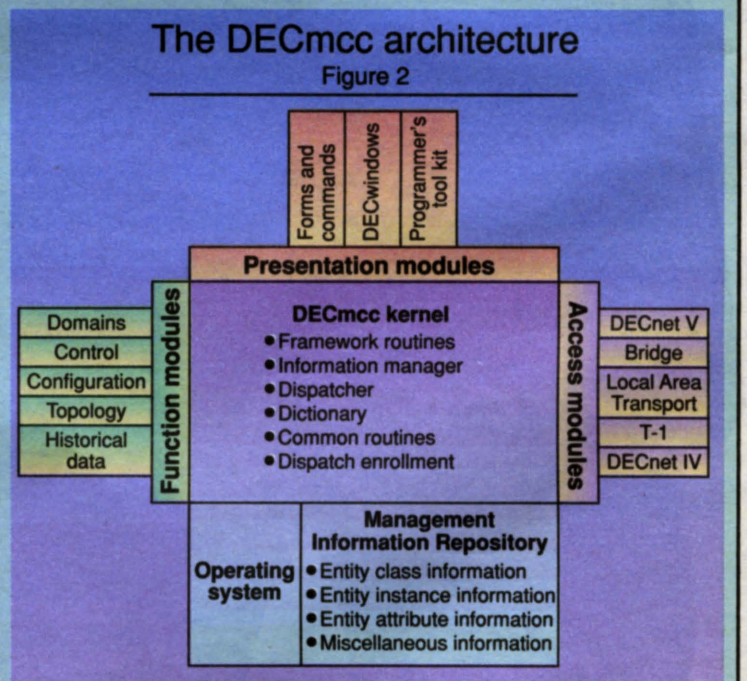
This plethora of protocols poses a real problem for the network manager. It's possible to hope that everybody migrates to a single standard. CMIP and SNMP are two standards often held out for this monolithic role.

However, the reality is that no single standard will do the job. Even if CMIP gets crowned, you can bet that new networks will add new protocols.

DEC has tackled this multiprotocol management problem by keeping multiple protocols but providing a single management environment known as the DEC Management Control Center (DECmcc). DECmcc is what's known as a director, a piece of software that controls devices on the network.

DECmcc has its own architecture, separate from the protocols it manages.

We can divide the task of managing the network into three pieces. First, there is the question of access. CMIP, SNMP and NICE are all examples of access protocols.



Next, we have the question of function. The function of turning a device on, for example, can apply to a variety of access protocols. In DECmcc, the function module issues a single call, which then applies to various entities on the network, each with an access protocol.

Finally, we have the question of presentation. One manager may have a workstation using the X Window System, another may have a simple DEC VT-100 terminal, and a third may have an IBM 3270 terminal.

By splitting up the functions, DECmcc allows a modular approach to network management. New modules can easily be added to the platform at run time, allowing new functionality to be added slowly.

Lying under all these modules is a data base management system — the management information repository. The repository contains information about the entities on the network as well as historical data.

— Carl Malamud